The effect of surface modification using novel electrochemical deoxidation technique on surface characteristics and initial cell response of zirconia materials

論 文 内 容 要 旨

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1.PURPOSE

The aim of this study was to investigate the surface characteristics and initial cell response of ceria-stabilized zirconia/alumina nanocomposite (NANOZR) in comparison to yttria-stabilized zirconia (3Y-TZP) and pure titanium (CpTi) modified by a novel electrochemical deoxidation technique (ECD).

2. MATERIALS AND METHODS

Discs with 15 mm in diameter and 1.5 mm thick of NANOZR (Panasonic Health Care Co, Japan), 3Y-TZP (Panasonic Health Care Co, Japan), and CpTi (Nippon Steel Co, Japan) were used in this study. The three surface treatment methods; mirro-polished (PS), sandblast-acid-etched (SB-E) and ECD were used in the experiments.

The surface morphology, chemical composition analysis, XRD diffraction, surface wettability, surface roughness and hardness were measured. In this study, MC3T3 osteoblast-like cells were used for evaluated the cell morphology and attachment on the specimens. Cell morphology and attachment also examined using confocal laser scanning microscopy and SEM.

All data were analyzed independently by one-way analysis of variance (ANOVA) combined with Least-Significant-Difference (LSD) multiple comparison test at a 5% level of significance.

3. RESULTS

NANOZR-E showed well-arranged and self-organized microporous surface structure and the lowest contact angle compared to other specimens ($P<0.05$). NANOZR-E also showed the slight decrease of the monoclinic phase (-4.4 wt%). The cell morphology and attachment on NANOZR-E were similar with CpTi-P and CpTi-S at 4 hours and 24 hours of incubation. NANOZR-E also showed higher cell affinity compared to 3Y-TZP-E.

4. CONCLUSION

Within the limitation of this study, our data demonstrated that the novel ECD technique is effective for the formation of micro-porous structure in NANOZR than CpTi and 3Y-TZP. Moreover, this novel ECD technique is useful to improve the cell response of NANOZR at initial stage.